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Brunchorst recently renamed *Frankia subtilis*. Frank regarded the peculiar cells always found in these tubercles as bodies of fungus origin, which had degenerated because of their mode of life within the cells of another plant. Moeller, on the other hand, regarded them as single-celled Hyphomycetes. From an extended series of experiments Hiltner<sup>1</sup> comes to the conclusion that *Frankia subtilis* is not a single-celled Hyphomycete, but a bacterial organism which possesses sporangia, and because of these and other peculiarities forms a connecting link between the bacteria and the true fungi. He succeeded in inoculating the organisms into roots of alder seedlings grown in N.-free nutritive solutions. The organisms enter through the root hairs in a manner similar to that of the organism causing leguminous tubercles. Inside of each hair is a mucilaginous thread in which the bacteria lie imbedded without any system or regularity. Before reaching the root proper the mucilaginous mass becomes filamentous and resembles mycelial threads. Within the root the mucilage masses resemble plasmodia, which extend from cell to cell, and ultimately become of a spongy consistency because of the appearance of numerous vacuoles, surrounded by thin walls of mucilage, in which the bacteria, now more or less in thread form, lie. Very soon after the formation of a tubercle the individual bacteria change into spheres filled with albumen, which rapidly differentiates into spores; in other words, the spheres represent sporangia. The spores germinate rapidly, forming short rods which fill the cells of the tubercle but develop no mucilage. Hiltner points out that, with the exception of *Bacillus erythrosporus*, few bacteria form sporangia. According to his view, the bacteroids of the leguminous tubercles must be regarded as sporangia, and in that case the bacteria of the alder and Leguminosæ, both forming plasmodia, constitute a new group of bacteria.

Numerous experiments have proven the fact that the organisms in the alder tubercles are capable of fixing atmospheric nitrogen; and, unlike those of the Leguminosæ, they are able to function fully under water. We are promised a full exposition of the subject in another journal at no distant date.

HERMANN VON SCHRENK.

**The Red and Blue Coloring Matters of Flowers** are discussed in *Natural Science* for February, by P. Q. Keegan, in continuation of a paper published in the same journal of December last. In view of

<sup>1</sup> Hiltner, L. On the Origin and Physiological Significance of Root-Tubercles. B. The Root-Tubercles of the Alders and Eleagnaceæ, *Forstlich Naturwissensch. Zeitschr.*, Bd. vii, p. 415, 1898.

the recent report of a blue carnation and the long horticultural search for a blue rose, it may be of interest to quote Dr. Keegan's conclusions: "1. A blue flower is unproducible in species which contain or are capable of forming phlobaphenic tannin [*i.e.*, chromogen, which on advanced oxidation evolves brown-red or muddy anhydrides more than sufficient to neutralize and overcome any tendency to blue coloration incident to the presence of gallic acid], no matter what the development of the inflorescence may amount to. 2. A blue flower is more likely to be produced in a species having a gamopetalous corolla or perianth, and therefore liable to evolve by higher oxidation a certain quantity of a high oxybenzoic acid. 3. In species wherein the tannin natural to the organism is iron-greening and non-phlobaphenic, a blue flower may possibly be producible in a polypetalous corolla, provided always that the petals or perianth be large relatively to the height of the plant and to the size and robustness of its stem and leaves; in this case it is uncertain whether gallic acid is necessary for the production of the effect, but any way an alkaline compound of an oxybenzoic acid would seem to be indispensable."

**Botanical Notes.**—Captain J. Donnell Smith, whose work on Central American botany is well and favorably known, publishes an enumeration of the plants collected in Central America by Dr. W. C. Shannon, as an appendix to Vol. I, Part II, of the report of surveys and explorations made from 1891 to 1893 by the Intercontinental Railway Commission. The "separates" of the article bear the imprint Washington, 1898.

Professor Peck's report of the state botanist, reprinted from the 51st annual report of the New York state museum, as is usual with his reports, contains descriptions and figures of a considerable number of fungi, several of which are believed to be new to science. It is unfortunate that, while the text is in octavo, the plates are of quarto size and separately bound.

At Bologna is preserved, in book form, the herbarium of Aldrovandi, dating from the middle of the sixteenth century. In *Malpighia*, Vol. XII, Fasc. 7-10, Professor Mattiolo, now of Florence, but until recently stationed at the University of Bologna, gives an annotated catalogue of the plants represented in the first volume of this herbarium, his list reaching 557 numbers.

*Acalypha hispida*, a New Guinea plant which, under the name of *A. sanderi*, is attracting a good deal of attention in horticultural